Electricity Supply and Price Security in San Diego County

Comparison of Strategies for the Production/Procurement of Electricity and Elimination of Greenhouse Gas Emissions

Research Brief Submitted To:
The San Diego Regional Apollo Alliance
By
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EXECUTIVE SUMMARY

This research brief compares two energy production and procurement options in terms of their ability to make San Diego County electricity price and supply secure. Both options require that San Diego County fully meet its electricity requirements.

- **Net-Meter Option** – San Diego County passes Community Choice Aggregation Ordinances and invests ratepayer dollars into becoming renewable electricity net-metered-out* by increasing its electricity use efficiency by 40% and by installing photovoltaic (PV) systems on 20.5% of its roofs and parking lots. *Net-metered-out means that San Diego County will be putting as many kWh into the Western States Grid each year as it uses from the grid each year.

- **Power Link Option** – SDG&E invests ratepayer dollars in building the Sunrise Power Link and Diego County continues to purchase imported electricity from SDG&E. In this Brief the Power Link is analyzed as being a continuation of the County's current dependence on imported electricity or imported natural gas or nuclear fuels to produce it in the County.

To determine which option best meets San Diego County's electricity supply and price security needs, each alternative was evaluated in terms of its contribution or threat to economic security and opportunity, energy security, public and environmental health, and social good. Our analyses indicate that the Net Meter Option provides the greatest benefit across all of these factors.

Analysis

Return On Investment – (ROI). Of the two Options, only the Net-Meter Option generates a return on investment to ratepayers and actually becomes self-funding after initial start-up capital sets it in motion.

Energy and Economic Security. The Net-Meter Option provides San Diego County the most economic security and opportunity by changing its current negative-electricity-purchase-cash-flow into a positive-electricity-purchase-cash-flow. The Net-Meter Option keeps the majority of the money the County currently exports to pay for imported electricity or imported natural gas to produce it locally -- in its local economy. This dollar export exceeded $1 billion in 2005.

The Net-Meter Option is fueled by inexhaustible solar energy which is delivered free. Therefore, it will protect San Diego County from economic shocks related to rapid rises in the cost of natural gas or other nonrenewable fuels whether such price hikes are real or contrived.

In contrast the Power Link Option will deliver imported electricity. Regardless of whether this electricity is produced renewably or with nonrenewable fuels, it will continue the current negative-electricity-purchase-cash-flow out of the County's economy.

If the average retail cost for electricity in the County is $.10 per kWh the County's 2010 negative-electricity-purchase-cash-flow will exceed $1.6 billion and grow to over $2 billion in 2050 assuming the County's population grows to 3.92 million by 2050. If the cost of natural gas doubles or triples as it did during the 2001-2002 energy crisis the negative cash flow related to purchasing natural gas to produce electricity locally or purchasing imported electricity produced by burning it would grow proportionally. This level of negative-electricity-purchase-cash-flow would adversely affect the economy.

The Net-Meter Option is the only strategy that can provide San Diego County with true electricity supply and price security. This is because solar energy in its various forms is our County's primary indigenous energy resource. All we have to do to harness this resource is to install sufficient efficiency improvements and devices to convert free solar energy into electricity. If the County were to net-metered-out, for all practical purposes it would become renewable electricity self-sufficient. Similar to power plants that depend on the grid for power when they are down for repairs and overhauls, solar generation would depend on the grid when there was insufficient local renewably generated electricity to meet the County's electricity needs. Once the County is renewable electricity net-metered-out, its PV system output would substantially exceed the County's need for electricity during the majority of its peak demand hours, when the sun is shining. This would reduce transmission congestion.

The Power Link Option is highly dependent on increasingly costly, politically vulnerable, finite supplies of natural gas and other non-renewable energy resources. It is difficult to predict the cost of natural gas and other nonrenewable energy resources -- especially, if liquefied natural gas is imported from terrorist and earthquake racked Indonesia to the Power Links terminus in Mexicali, Mexico. This is SDG&E's current plan. Therefore, the Power Link Option does not provide real energy price and supply security.

Social and Environmental Good. The Net-Meter Option will be virtually health and environment benign because solar generated electricity produces no pollution or greenhouse gases. It will also stimulate local business and employment

The Power Link will deliver electricity produced in distant power plants primarily by burning natural gas or some other nonrenewable and polluting energy sources. While this will minimizes local pollution, it will increase it globally because of transmission losses.

Proof of Concept

As the first step toward making the Net-Meter Option a reality, this brief proposes that San Diego County begin with a modest **Proof of Concept Project**. This project would consist of the County Board of Supervisors issuing a Request for Proposals (RFP) to qualified bidders to make the County 2% renewable electricity net-metered-out by mid 2010. Specifically, we propose that the San Diego County in partnership

with the San Diego Apollo Alliance develop a *Proof of Concept Project* that would mirror the County's current electricity use profile of 4% large commercial, 28% medium commercial, 7% small commercial, 7% agriculture and 54% residential. By maintaining this ratio, the success of the Proof of Concept Project would validate the security, economic, health, and public good benefits outlined in this brief and provide an economic model that the County could apply to becoming completely renewable electricity net-metered-out.

San Diego County would issue an RFP for the Proof of Concept Project to qualified bidders. Qualified bidders would include Energy Service Companies (ESCOs) and SDG&E. ESCOs are companies who help clients reduce energy costs by improving their energy use efficiency and developing their renewable energy resources. ESCOs typically supply the working capital to perform the work they do. They pay back their capital investment and make their profits by sharing in the savings on energy costs that the work they perform makes available. Once finance costs are paid and profit margins are met, the ESCO's role ends. After that, all the savings generated by the improvements go to the client, which in this case would be San Diego County, its residents and resident businesses.

INTRODUCTION

One of the greatest dangers to the public's well being in San Diego County and our region is our almost total dependence on imported and non-renewable energy resources. Recent history has shown that we have little if any control over the near-term supply or price of these resources. Long-term control is even more problematic given that non-renewable energy resources are finite in supply, often located in politically unstable countries, and the competition for them is growing worldwide. Additionally, the supplies that are still exploitable are in ever more remote and difficult to access locations. They therefore require the consumption of increasing amounts of energy just to bring them to market. Another related issue is global warming and how best to respond to its challenge while insuring that our region has a plentiful, secure and affordable energy supply.

Energy Production and Procurement Options

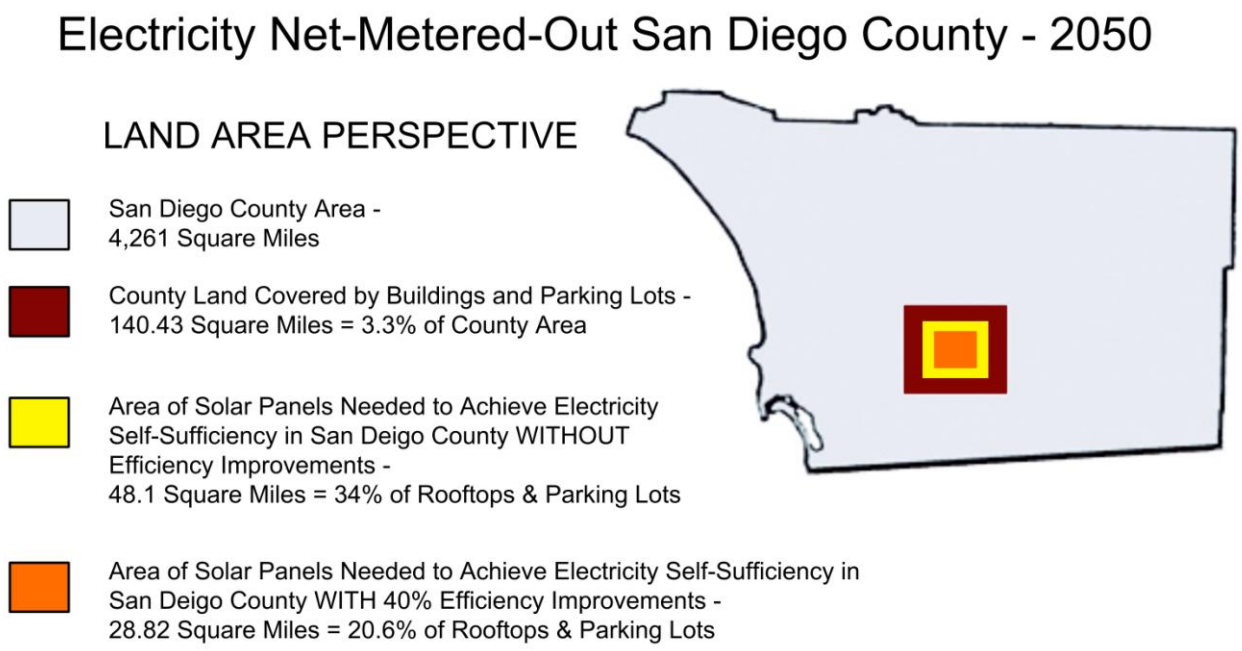
Net-Meter Option. San Diego County becomes renewable electricity net-metered-out by increasing its electricity use efficiency by 40% and by covering 20.5% of its roofs and parking lots with photovoltaic or PV systems.[1] (See Chart 1, p. 7)

Power Link Option. SDG&E builds the Power Link and San Diego County increases its purchase of imported electricity from SDG&E.

Note: Even though the cost per kWh varies, all cash flow related calculations in this document assume an average cost of $.10 per kWh over the 40 year time period from 2010 through 2050 this brief covers.

[1] This 20.5% of the county's roofs and parking lots is based on the authors' original work analyzing a 2004, 10' by 6' map of Chula Vista so detailed that cars could easily be seen in parking lots and on streets. This analysis showed that there is around 1,000 square feet of roofs and parking lots per capita in Chula Vista. This brief assumes the 1,000 square feet of roofs and parking lots per capita can also be applied to the County as a whole. Since roofs and parking lots grow with population, multiplying the County's population in any particular year by 1,000 sq' per capita will equal the number of square miles of roofs and parking lots the county has or will have in that year. The 20.5% calculations also assume an average of 5 hours sunlight per day and PV panels that are 10% efficient at converting sunlight into electricity. It is also assumed that at 10% efficiency it requires 2 square meters of PV panels to produce an average one kWh of electricity per day in San Diego County. For reference, 22.6 sq. miles and 110 square miles equals .53% and 2.58% of the County's land area.

CHART 1
Electricity Self-Sufficiency in San Diego County



Assumptions:
+ San Diego County's population ---------- 3,915,085
+ Square Feet of Rooftops and Parking Lots per capita ---------- 1,000 ft^2
+ Total kWh use per capita per day (with 0% efficient use improvements) ---------- 15.9 kWh
+ Total kWh use per capita per day (with 40% efficient use improvements) ---------- 9.54 kWh
+ PV system efficiency ---------- 10%
+ Yearly average hours of productive sunlight per day ---------- 5 Hours

ANALYSIS

Return On Investment (ROI)

Both options presented in this brief require a capital investment.

Net-Meter Option ROI - Although some initial start up capital may be needed to develop an RFP for the Net-Meter Option, qualified Energy Service Companies (ESCO) will supply the necessary working capital for this option. For more information about ESCOs, search the web for the "National Association of Energy Service Companies." If SDG&E bids the Net-Meter Option, SDG&E will also be required to supply the working capital just as it will for the Power Link. There is also the possibility for the County to save ratepayers money through a private/public partnership with an ESCO or with SDG&E. In this scenario the County would secure funding for the Net-Meter Option at a lower interest rate than is available to an ESCO

or SDG&E through the municipal bond process. The Net-Meter Option's strategy is to invest 97% of the initial working capital into increasing electricity use efficiency and only 3% to install PV systems until all the efficiency improvements at $1.000 per kW saved are installed. Installing efficiency improvements at a $1,000 per kW saved for 10 hours per day generates 10 times more income per dollar invested than does investing $5,000 to install a kW of PV production capacity that produces electricity on average 5 hours per day.[2]

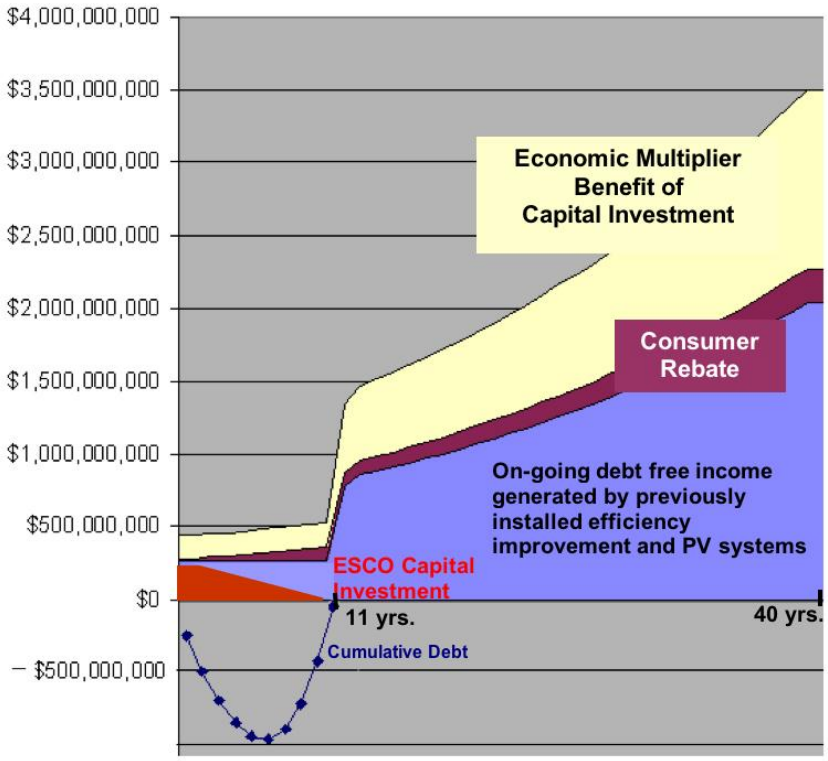
Whatever the origin of the start up and working capital to finance either option, the Net-Meter Option requires the least amount of borrowed working capital and generates the best return on investment to ratepayers. It is also the only option that gives consumers a 10% rebate. Graph 1 on p. 9 shows that with an initial investment of $275,000,000 and investing an average of $160 million per year of borrowed start up capital (14.5% of San Diego County's 2005 negative cash flow) per year for 6 years would allow the County to maintain average working capital level of $275,000,000 through the first 10 years of the Net-Metering process. This investment strategy would generate sufficient additional income to give consumers a 10% rebate and pay back the $960,653,333 borrowed during the first 6 years, by year 11, ($160,108,889 million x 6 years equals $960,653,333). This will be true whether financing is provided by an ESCO or by SDG&E. If the County chooses to fund the project through a lower interest rate municipal bond, the payback would be even faster.

Once the working capital is paid off the income from past efficiency and PV system installations sharply increases the working capital available for new installations. From $275,000,000 per year during the first 10 years it jumps to $779,067,904 by year 11. This is why the graph spikes upward starting in the last part of year 11. Beginning in year 13 the graph flattens out again. With no more $1,000 per kW efficiency improving opportunities left, all the income from past installations is shifted to installing PV systems. Because PV systems produce less income per dollar invested than efficiency improvements, the growth in yearly income slows down.

In summary, the Net-Meter Option involves borrowing $960 million in start up capital that is repaid over an 11 year time period. The investment provides a return to ratepayers and stimulates the local economy. When ratepayers pay their electricity bill their return comes in the form of a 10% rebate. These payments also develop in-region efficiency assets and PV infrastructure.

[2] The National Renewable Energy Laboratory (NREL), Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors. P. 42, shows that coastal San Diego County (elevation 9 meters or 29.54 feet) gets a yearly average of 5 hours of sunlight per day on horizontal surfaces and 5.5 hours on collectors tilted 33 degrees from horizontal toward the South.

GRAPH 1
Economic Benefits from Electricity
Energy Self-Sufficiency Investment



Power Link Option ROI

The Power Link Option in contrast will cost $1.3 billion, all of which will have to be paid for by ratepayers.[3] Additionally, ratepayers will also pay for the electricity imported, including the natural gas burned to make it. Even when natural gas is imported to produce electricity in resident power plants, 80% to 96% of the cost per kWh goes to the natural gas supplier. The higher the cost of natural gas the larger the percent of the cost for electricity it makes up. Additionally the electricity delivered by the Power Link have transmission losses. [4]

With the Power Link Option, County residents, resident businesses and government do not receive any rebate on their electricity bill. No in region efficiency assets or PV infrastructure are developed by the Power Link investment. Even though some of the wages paid to construct the Power Link will be paid to County residents, the resultant positive cash flow into the County's economy will be dwarfed by the negative cash flow created by the County's dependence on imported electricity delivered via the

[3] Some will argue that San Diego ratepayers will only have to pay 10% of this cost because other ratepayers, state wide, will pay the rest. But since San Diego County ratepayers help to pay for other utility projects around the state, County ratepayers, more or less, end up paying for the whole thing.
[4] U.S. high voltage electricity transmission losses are around 4%. U.S. Climate Change Technology Program – Technology Options for the Near and Long Term. (November 2003): p. 34.

Power Link and imported natural gas to produce electricity locally. Even if renewably generate electricity is imported via the Power Link its purchase will result in a negative cash flow out of the County's economy.

Energy and Economic Security

Net-Meter Option Leverages Indigenous Energy Resource

The Net-Meter Option provides the highest level of energy security of the two energy procurement options compared in this brief. It leverages a plentiful and free indigenous resource. All that is required to harness this resource is to install enough efficiency improvements and PV systems to supply the electricity the County needs. As such, every dollar invested in the Net-Meter Option constitutes an "insurance payment" toward achieving complete electricity supply and price security in the County regardless of what happens in national, continental and global energy markets.

The risks associated with energy procurement, distribution, and transmission, are a function of the cost and reliability of the primary energy supply and the vulnerability of its deliver system. Because energy to power the Net-Meter Option is free, delivered free and will never run out, issues related to distant transmission and dependence on supply uncertain and price volatile nonrenewable energy resources are largely eliminated.

After the County becomes net-metered-out there will still be some dependence on the grid as a "storage battery". To the degree the County develops local storage capacity such as pump storage, it can reduce grid dependence. An example would be to pump water to higher elevations when PV output is high and then use this system to power turbines when PV output is low or not viable (at night). Another option to store electricity is via air compression, chemically (as in batteries and bio fuels) and as inertia such as with vacuum chamber flywheels. The more energy storage the County develops, the less it will need the grid for back-up.

Net-Meter Option Provides Protection from Energy Supply and Price Shocks

Another Net-Meter Option benefit is that it is an electricity supply system fueled by free renewable energy. As a result it will protect the County from economic shocks related to sharp rises in the cost of imported nonrenewable generated electricity or natural gas to produce electricity locally. An additional economic benefit unique to the Net-Meter Option is that being renewable electricity net-metered-out means that San Diego County will no longer be hurt financially if electricity coming from the grid rises in price. This is because once it is renewable electricity net-metered-out the County will change from being a net electricity purchaser to a net electricity trader. As an electricity trader, the cost of a kWh used in the County from the grid becomes irrelevant. If a kWh from the grid costs 10 dollars, every kWh the County contributes to the grid will be worth 10 dollars. As long as the County puts at least as many renewable energy generated kWh into the grid each year as it uses from it, there will be no kWh cost from the grid.

Net-Meter Option Offers Potential for Decreased Energy Prices

An additional economic benefit of the Net-Meter Option is that once San Diego County is renewable electricity net-metered-out the price that County ratepayers pay per kWh can go down. This is because solar energy is free. With no energy costs, the only cost after the Net-Meter Option is completed will be to maintain the system and add to it as population grows. PV panels have a 25-year performance warrantee and only 1% of the total PV system to be installed will be in place by the end of year 2025 in this model. This means that even if PV panels fail the day they turn 25, only 1% of the PV systems would require placement during the 40 years this analysis covers. A more likely scenario is that panels will continue producing electricity long after their 25-year warrantee ends and as the technology matures, PV panels with longer warrantees and better performance will enter the market place. Efficiency improvements like better insulation and dual pained windows last the life of the building where they are installed. Even efficiency improvements like more efficient lighting systems, appliances and electric motors that wear out, generally require less maintenance because they last longer than what they replace. Additionally, with increased scales of production and increased efficiencies, all indications are that the price of electricity produced by PV panels will continue to drop.

Power Link Option Relies on Uncertain Energy Supply and Provides Minimal Protection from Energy Supply and Price Shocks

The electricity that Power Link Option proposes to deliver depends primarily on price and supply uncertain natural gas and other nonrenewable fuels. This is particularly true for the Power Link because its primary source of electricity will be produced in Mexicali Mexico by plants burning natural gas imported from terror and earthquake wrack Indonesia. Even if the natural gas was imported from a less vulnerable source, predictions regarding the price or supply of natural gas and other nonrenewable fuels are difficult in the short term. Long term price stability is not guaranteed. The price of natural gas and other non-renewable energy sources that supply power plants are likely to rise over time. This uncertainty makes it difficult to make sound decisions about maximizing electricity supply and price security. Therefore the Power Link cannot provide protection against energy supply and price shocks.

Natural gas power plants, the main supplier of electricity the Power Link will deliver, have to be replaced every 30,000 hours of operation or every 4 years for plants running at full capacity (85% capacity factor). This is a much shorter time frame for replacement than efficiency or PV systems require.

Economic Opportunity

Net-Meter Option Converts a Negative Cash Flow into a Positive One -The Net-Meter Option provides more economic security and opportunity than the Power Link Option because it converts the County's current negative-electricity-purchase-cash-flow into a positive-electricity-purchase-cash-flow. With no fuel or fuel delivery costs the dollars currently exported to pay for imported electricity or natural gas to produce it locally stay in the County in the form of expanded local business and employment

opportunities. Initially, new business and jobs would revolve around manufacturing and installing efficiency improvements and PV systems. (This Brief only look as installation benefits not manufacturing.) But since most of the local profits and wages from becoming net-metered-out will be spent locally, the local economy will benefit as a whole.

Power Link Option Perpetuates a Negative Cash Flow

The Power Link Option perpetuates the County's current negative-electricity-purchase-cash-flow. The total purpose of the Power Link Option is to import electricity. The dollars we pay for the electricity the Power Link supplies will be exported out of the County's economy to pay fuel suppliers and out of region power plant owners and operators.

The price of imported renewably generated electricity the Power Link Option proposes to deliver for local consumption will not be directly affected by increases in the cost of nonrenewable fuels. However, this electricity will still be imported. As a result this procurement continues to create a negative-electricity-purchase-cash-flow out of the County's economy.

In summary, the Power Link Option is a continuation of the County's current price and supply vulnerability and results in a negative-electricity-purchase-cash-flow. Assuming $.10 per kWh, the County's negative-electricity-purchase-cash-flow is now well over $1 billion per year and growing. Assuming an average cost of $.10 per kWh the County's negative-electricity-purchase-cash-flow will top $1.6 billion by 2010. If the price of natural gas rises, the County's negative-electricity-purchase-cash-flow will rise with it.[5]

Once money to purchase electricity leaves the County, it generates zero local business, employment or tax revenues. If we could wave a magic wand and make San Diego County net-metered-out in 2010, the County's projected negative-electricity-purchase-cash-flow of $1.64 billion would be converted into a $1.64 billion positive-electricity-purchase-cash-flow into the County's economy. Money available to stimulate local business activity, create jobs and generate local tax revenues. Assuming that every dollar kept in the County generates at least one additional dollar

[5] This $1.65 billion number was derived by multiplying SANDAG's projected San Diego County's 2010 population of 3,211,721 by 15.9 kWh per capita per day then multiplying the result, 51,066,364 kWh per day by 365 days which equals 18,639,222,820 kWh projected to be consumed in San Diego County in 2010. Multiplying 18,639,222,820 kWh by $.10 per kWh equals $1,863,922,282. To reflect the cost of the natural gas consumed in the process of generating electricity, which is 88% of the cost at $.10 per kWh, $1,863,922,282 is multiplied by 88% to arrive at $1,640,251,608. FYI - As natural gas costs rise, the percent of the cost per kWh produced by using it rises. At $5 per MM BTUs, (million BTUs), natural gas makes up 76% of the cost of a kWh costing $.046 per kWh. At $10.00 per MM BTUs, the percent of the cost of the natural gas to produce a kWh goes up to 86% per kWh now costing $.08. This happens because the cost of running a modern natural gas power plant is fixed at about $11.15 per 1,000 kWh (1 MWh) produced. This means that as the cost of natural gas rises, the percent of the cost of a kWh produced by burning natural gas goes up with it.

of economic activity, the economic-multiplier benefit of keeping $1.64 billion local would be to increase 2010 economic activity in the County by $3.28 billion.[6]

Net-Meter Option Allows County to Become Power Plant Owners Instead of Power Supply Renters

With the Net-Meter-Option as County residents and businesses pay their electricity bills they also gain equity in and income from a renewable energy powered "power plant" running on free fuel that will never run out.

Power Link Option Subjugates County to Power Supply Renters

With the Power Link Option the County and its residents and businesses continue renting their electricity (pay for electricity forever but never own anything) from sources and through transmissions systems that provide little if any electricity supply or price security.

Employment Opportunity

To conduct this job analysis it is assumed that local direct job-years of employment will be generated through the implementation and operation of each option. Indirect job-year employment will be generated by the positive cash flow into the County's economy from the direct job-year wages paid to County residents who construct and maintain each option.

The direct job-year and indirect job-year totals for each option are presented in Table 1.

The calculations that follow assume that a job-year equals 40 hours of work per week for a total of 50 weeks per year plus a 2-week paid vacation. It is also assumed that the average direct job-year wage is $54,080 and the average indirect job-year wage is $46,000 in 2005 dollars.

Direct Job-years

- Net-Meter Option – For San Diego County to net-meter-out for electricity through 2050, 124,182 direct job years of employment will be created. Installing 7,450.9 MW of PV system capacities will create 96,862 direct job-years of employment. Installing 2,483.6 MW of electricity use efficiency improvement will create 27,320 direct job-years. Dividing the Net-Meter Option's direct job-year total of 124,182 direct job-years by 40 years equals an average of 3,104.6 direct job-years of employment each year. [7]
- Power Link Option – Assuming that 40% of the $1.3 billion cost of the power link will be paid in wages, the Power Link Option will require 9,615.38 direct

[6] $1.64 billion x 2 = $3.28 billion.
[7] Net-Meter Option – 124,182 direct job-years, Assumptions and calculations see Appendix 3A and 3B.

job-years of employment to complete. [8] Multiplying $1.3 billion by 40% = $520 million. Dividing $520 million by $54,080 equals 9,615.4 direct job-years of employment or an average of 240.4 direct job-years of employment per year over the 40 years covered in this brief.

Indirect Job-years

This brief assumes that all indirect job-years created during the process of San Diego County becoming net-metered-out will result from the direct Job-year wages paid to County residents employed to implement each option. Based on the job data discussed in Appendix 3.A & 3.B this brief assumes that 13 direct Job-years will be created per MW of PV system installed and 11 direct job-years required per MW of electricity use efficiency installed.

The brief also assumes that the number of indirect job-years generated by building and maintaining the Power Link Option are based on industry norms for the average direct job-years needed to construct and maintain large transmission lines and associated sub-stations. It is assumed that both options pay an average direct job-year wage of $54,080 in 2005 dollars.[9]

To determine the number of local indirect job-years generated by each option we assume that number of indirect jobs are a function of the positive cash flow into the County's economy generated by the direct job-year wages paid to county residents employed to construct and maintain each option. In the case of the Net-Meter Option, the 10% consumer rebate it returns to County ratepayers is added to its positive cash flow total.

Once the total positive cash flow generated by each option is determined, it is multiplied by an economic multiplier of 2 to arrive at each option's economic multiplier benefit. The resultant numbers are then multiplied by 57%, the percent of national GNP made up of wages. The result is then divided by $46,000 (Average wage in California in 2005) to arrive at the number of indirect job-years generated by each option. [10]

- Net-Meter Option – This option will create 286,998 indirect job-years paying an average of $46,000 per year over 40 years or an average of 7,175 indirect job-years per year. (See Appendix 3.A and 3.B)
- Power Link Option – This option will create 12,887 indirect job-years over the 40 year period covered in this brief, an average of 322 indirect job-years per year. (See Appendix 4)

[8] Power Link Option – For details, see Appendix 4.
[9] Conversation with Jim Avery, SDG&E's lead person for the Power Link Option.
[10] Bureau of Labor Statistics, U.S. Department of Labor, San Francisco CA 94119, BLS 06-07, Released Monday, (January 23, 2006), p. 1. The average wage per week in California in the first quarter of 2005 was $872. Multiplying $872 by 52 weeks equals $45,344 per year.

TABLE 1

Direct and Indirect Job-Year Totals

	Job-Years Required to Install and Maintain PV Systems	Job-Years Required to Construct and Maintain the Power Link	Job-Years Required to Install and Maintain Electricity Use Efficiency Improvements	Total Job-years	Average Job-years (per year)
Direct					
Net-Meter Option	96,862	---	27,320	124,182	3,104.6
Power Link Option	---	9,615.4		9,615.4	240.4
Indirect					
Net-Meter Option	172,193	---	114,795	286,988	7,175.0
Power Link Option	---	12,887		12,887	322.2
	---	---			

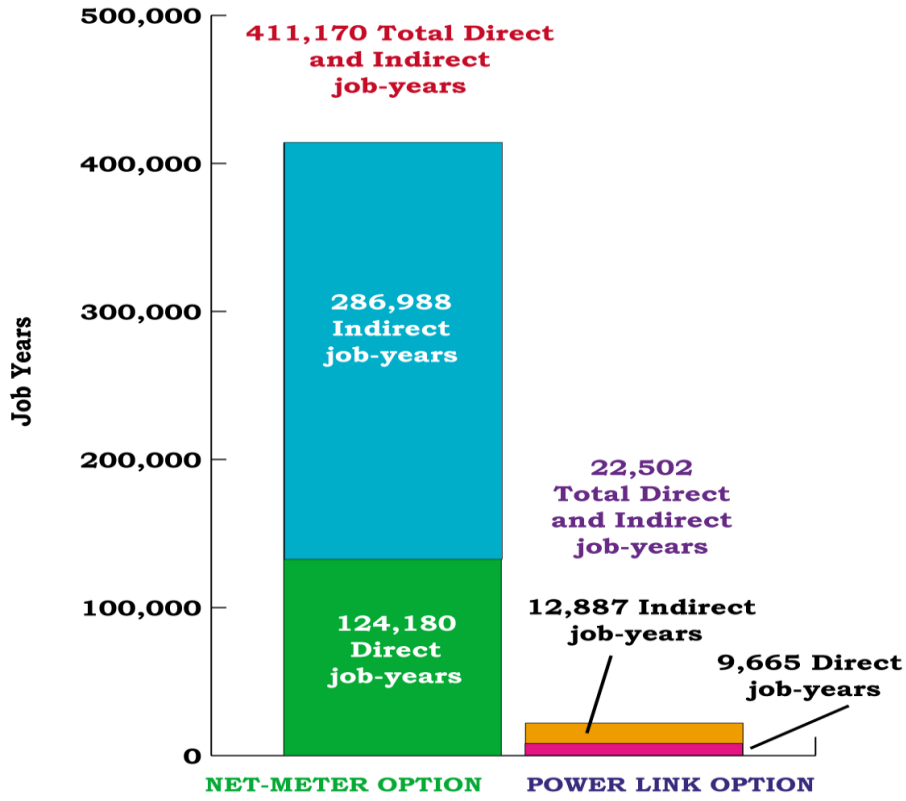
Net-Meter Option Generates 13X Increase in Direct Local Employment Compared to the Power Link Option

Comparing the number of direct job-years generated by each option indicates that the Net-meter Option will create 12.9 times more direct job-years of employment than the Power Link Option. [11] The Net-Meter will also generate 22.3 times more indirect job-years of employment than the Power Link Option. [12] See Chart 2.

[11] Dividing the Net-Meter Option's 124,182 direct job-years required to install and maintain sufficient PV panels and efficiency improving measures to meet San Diego County's 2050 electricity needs by the 9,615,4 direct job-years created with the Power Link Option shows that the Net-Meter Option One will create 12.9 times more direct job-years of employment than the Power Link Option.

[12] Dividing the Net-Meter Options 286,988 indirect job-years by the Power Links 12,887 indirect job-years shows that the Net-Meter Option will create 22.3 times more indirect job-years of employment than will the Power Link Option over a 40 year period.

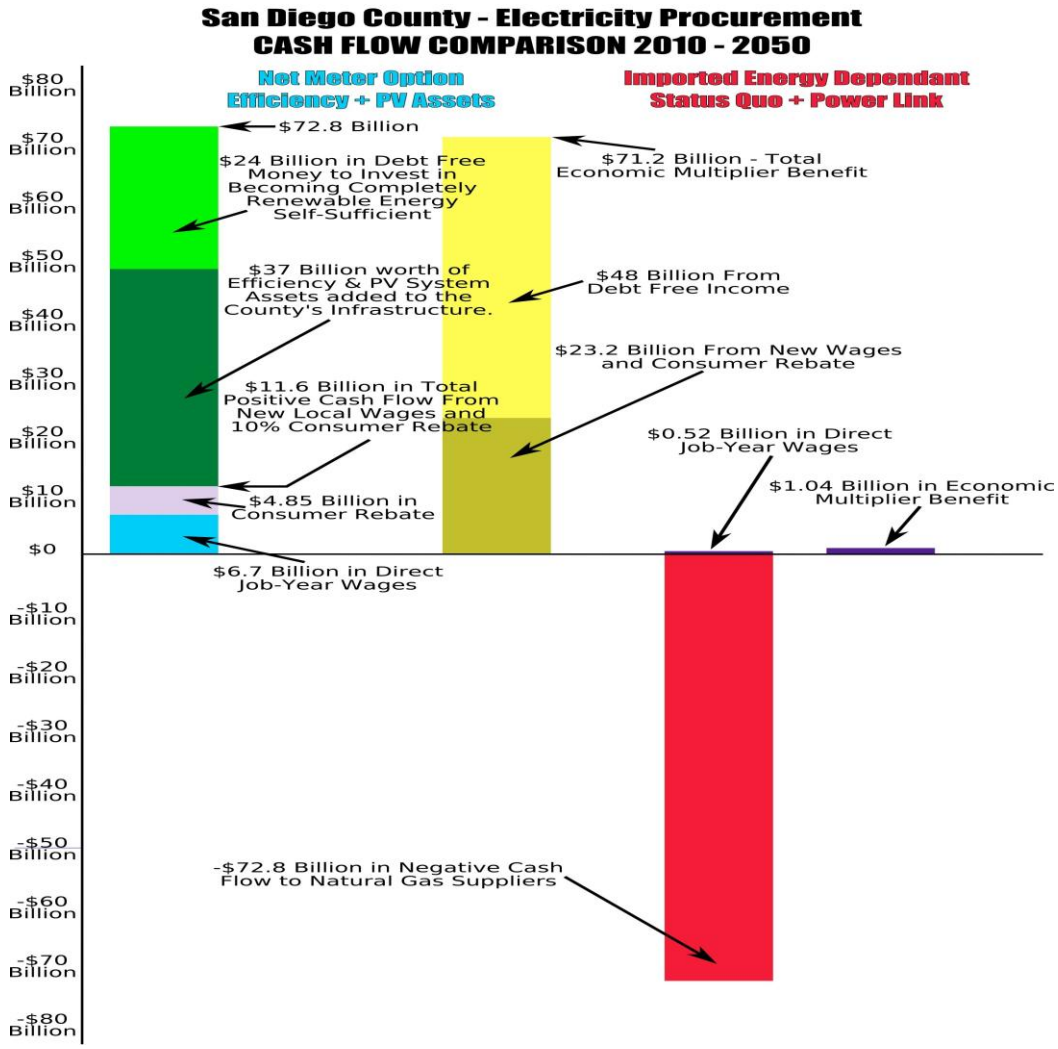
CHART 2
JOB CREATION COMPARISON 2010 - 2050

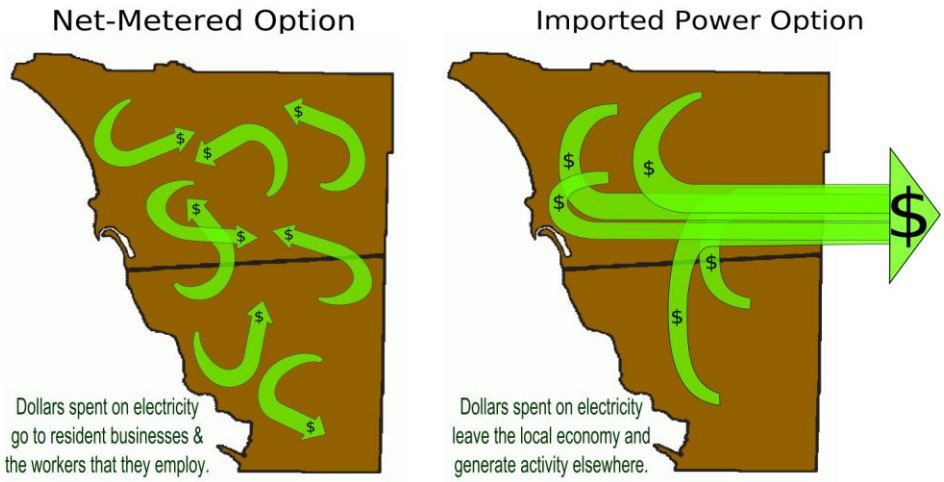


In summary, the Net-Meter Option generates significantly greater cash flow into the local economy than the Power Link Option. It eliminates negative cash flow out of the economy for imported energy and instead develops local energy production assets, PV and efficiency. Investment in these assets generates more direct job-years of employment than the Power Link Option and the proposed financial model provides a consumer rebate. The income from the employment and consumer rebate multiples through the local economy.

In contrast, the Power Link Option maintains the negative cash flow out of the economy and does not develop local energy production assets. The continued negative cash flow for energy procurement dwarfs the direct-job wages created and the resultant economic multiple in the local economy. See Chart 3.

CHART 3


San Diego County - Electricity Procurement
CASH FLOW COMPARISON 2010 - 2050
Net Meter Option
Efficiency + PV Assets
Imported Energy Dependant
Status Quo + Power Link
$80 Billion
$70 Billion
$60 Billion
$50 Billion
$40 Billion
$30 Billion
$20 Billion
$10 Billion
$0
-$10 Billion
-$20 Billion
-$30 Billion
-$40 Billion
-$50 Billion
-$60 Billion
-$70 Billion
-$80 Billion
$72.8 Billion
$24 Billion in Debt Free Money to Invest in Becoming Completely Renewable Energy Self-Sufficient
$37 Billion worth of Efficiency & PV System Assets added to the County's Infrastructure.
$11.6 Billion in Total Positive Cash Flow From New Local Wages and 10% Consumer Rebate
$4.85 Billion in Consumer Rebate
$6.7 Billion in Direct Job-Year Wages
$71.2 Billion - Total Economic Multiplier Benefit
$48 Billion From Debt Free Income
$23.2 Billion From New Wages and Consumer Rebate
$0.52 Billion in Direct Job-Year Wages
$1.04 Billion in Economic Multiplier Benefit
-$72.8 Billion in Negative Cash Flow to Natural Gas Suppliers


Net-Metered Option
Imported Power Option
Dollars spent on electricity go to resident businesses & the workers that they employ.
Dollars spent on electricity leave the local economy and generate activity elsewhere.

Social and Environmental Good. The Net-Meter Option generates the greatest social good because it does the most to stimulate local business activity, create jobs, upgrade infrastructure and generate tax revenues. It also does the most to reduce pollution and greenhouse gas emissions.

The nonrenewable electricity delivered through the Power Link will be produced in distant locations and will primarily draw electricity from plants powered by natural gas or other nonrenewable and polluting energy sources. This minimizes local pollution but it does not eliminate it. Burning natural gas and other non-renewable energy sources will still damage human and environmental health in air sheds and watersheds where the power plants San Diego County draws from operate. Additionally, the total amount of pollution and greenhouse gas emissions per kWh of electricity used in San Diego County would increase over all because more electricity would have to be produced to make up for long distance transmission losses.

Net-Meter Option Addresses Global Warming and Climate Change

The Net-Meter Option does the most to minimize the release of greenhouse gases like carbon dioxide (CO2) and natural gas or methane (CH4) into the atmosphere. Solar energy in its various forms and efficiency installations do not generate greenhouse gases.

Power Link Option Does Not Address Global Warming and Climate Change

While electricity imported to us through the Power Link will not increase local air, water and soil pollution it will still pollute another region's air and watershed. Additionally, with transmission losses, it will actually release more pollution and greenhouse gas per kWh of electricity delivered to us than if imported natural gas was burned in San Diego County to produce it locally. On average, high voltage transmission losses are around 4% in the U.S.[13] (See Appendix 6 for more details on global Warming.)

PROOF OF CONCEPT

This part of the brief introduces the idea of the County Board of Supervisors issuing an RFP (Request for Proposals) to qualified bidders to make the County 2% renewable electricity net-metered-out by mid 2010.

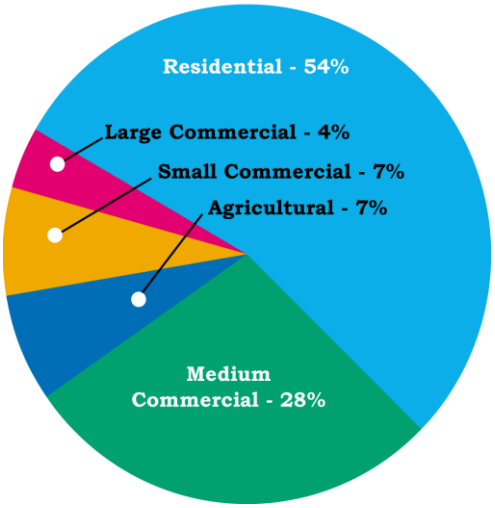
The basic concept is for the County of San Diego to become a Community Choice Aggregation municipality under California State law Assembly Bill 117, then partner with the San Diego Apollo Alliance to develop a modest Proof of Concept Project that would mirror the County's electricity use profile. The County's electricity use profile is 4% large commercial, 28% medium commercial, 7% small commercial, 7% agriculture and 54% residential.[14]

[13] U.S Climate Change Technology Program – Technology Options for the Near and Long term. (November 2003): p. 34.

[14] Navigant Consulting et. al. Community Choice Aggration, Base Case Feasibility Evaluation, San Diego County. (May 2005): p. 145.

CHART 4

SAN DIEGO COUNTY
ELECTRICITY USE PROFILE
2005



The implementation of the Proof of Concept Project would allow the County to verify the positive security, economic, health, environment and public good benefits described in this brief. The validation of the positive economic outcomes from the project would provide the County the confidence to issue additional RFP for larger projects aimed at becoming completely renewable electricity net-metered-out as discussed in this brief.

Once a detailed proposal is developed San Diego County would issue RFPs to qualified Energy Service Companies (ESCOs) and other qualified bidders, including SDG&E, to make the County 2% percent renewable electricity net-metered-out by mid 2010 as the first step toward making the County completely electricity net-metered-out by 2050.

Included in the Proof of Concept Proposal would be the following requirements designed to maximize the economic benefits for San Diego County, its residents and resident businesses during the implementation of the initial project and its expansion after the first phase is completed. For any proposal to be seriously considered, qualified bidders would have to:

1. Provide the initial investment capital.

2. Propose a project that would closely parallel the County's energy use profile. See chart on p. 19.

3. Be bonded to guarantee a positive cash flow throughout the implementation of the project and during its warrantee period, i.e. the 10% consumer rebate.

4. Employ local people and local businesses to the greatest extent possible at

prevailing wages and benefits to manufacture and install products like double paned windows and skylights, insulation, more efficient appliances, lighting, solar panels, windmills, etc. Following this strategy will maximize the local economic benefits of the County becoming renewable electricity net-metered-out.

5. Require that all products used in projects be designed to meet the highest human health and environmental standards in their creation, use and recycling or disposal at the end of their use life.

6. Contribute to training an expert workforce to manufacture and install renewable energy collection systems and energy efficiency improvement products.[15]

CONCLUSION

By becoming renewable electricity net-metered-out, San Diego County can greatly increase its electricity supply and price security and therefore its economic security. Additionally, once completed, the Net-Meter Option will eliminate all greenhouse gas emissions related to the production and use of electricity in our County.

Building on the skills developed in the process of becoming renewable electricity net-metered-out, the County has the opportunity to take a leadership role in developing the model for cities, states and countries around the world to become renewable electricity self-sufficient.

With its ongoing CO2 reduction programs and its attention to designing County facilities to be more energy efficient than required by code, San Diego County is already taking a leadership role in making its self and its resident communities more energy secure. The proof of concept project being proposed in this brief is just the next step on a journey San Diego County has already been on for a number of years.

Beyond the Proof of Concept Project, Community Choice Aggregation process is one mechanism that might allow San Diego the flexibility to implement the Net-Meter model proposed in this paper, large scale.

If the County as a whole or even any one of its cities made a strong move toward becoming renewable electricity net-metered-out, the security and economic benefits of doing so will be so attractive that it is likely that many cities in the State of California would implement this model and become net-metered-out for electricity then continue on to becoming completely renewable energy self-sufficient.

[15] To maximize the benefit to San Diego county's economy during its transition to becoming renewable electricity net-metered-out, existing programs to train workers for these new jobs need to be greatly expanded. An expanded skilled labor workforce is essential to the County becoming renewable electricity net-metered-out.

APPENDIX 1
San Diego County – 2005
Assumptions and Calculations used in this research brief.

Total area	4,261 Sq. miles[16]
Total land area	4,216.5 Sq. miles[17]
Population	3,066,820[18]
Total use of electricity County wide	17,785,040 MWh[19] (17,785,040,000 kWh)
Total average use of electricity per day Total average kWh us per capita per day	48,726.137 MWh (48,726,137 kWh) 15.9 kWh per capita per day [20]
Total use of electricity per day if a 40% improvement in the efficient electricity use had been achieved	29,235.682 MWh (29,235,682 kWh) 9.54 kWh per capita per day[21]
Estimated total roofs and parking lots	110 Sq. miles[22]

[16] SANDAG. Fast Facts, San Diego Region, www.sandag.org/resources/demographics, 9/3/06: p. 1.
[17] Email from Troy Anderson. Sr. Public Information Officer, SANDAG, (1/2/07): p. 1. San Diego County's 4,261 sq. miles includes 44.5 square miles covered by lakes, reservoirs and bays.
[18] SANDAG. Fast Facts, San Diego Region, www.sandag.org/resources/demographics, 9/3/06: p. 1.
[19] Telephone conversation with Susan Freedman of SANDAG who reported that SDG&E sold 19,544 GWh of electricity in 2005. The 17,785,040,000 kWh number was derived by multiplying 19,544 GWh by 91%, then by 1,000,000 kWh per GWh. San Diego County makes up 91% of SDG&E's service area.
[20] Ibid. Dividing 17,785,040,000 kWh by 365 days per year equals 48,726,137 kWh per day. Multiplying 48,726,137 kWh per day by 60% to reflect a 40% increase in electricity use efficiency equals 29,235,682 kWh.
[21] Dividing 48,726,137 kWh used per day by San Diego County's 2005 population of 3,066,820 equals 15.9 kWh per capita per day. Multiplying 15.9 kWh per capita per day by 60% equals 9.54 kWh per capita per day electricity use with a 40% increase in electricity use efficiency.
[22] The square mile estimate is based on assuming there are 1,000 square feet of roof and parking lot per capita in San Diego County. Multiplying 1,000 sq.' per capita by the County's 2005 population of 2,966,151 equals 2,966,151,000 sq.' Dividing 2,966,151,000 sq.' by 27,878,400 sq.' per sq. mile equals 106.4 sq. miles. The 1,000 sq.' of roofs and parking lots per capita numbers is based the author's original work analyzing a 10' x 6' map made from an aerial photo of the City of Chula Vista in 2004. (This map is so detailed that individual cars can be seen in parking lots and driveways.) Our methodology consisted of dividing Chula Vista's developed lands into 48 areas of development then subtracting parks, playing fields, wildlife areas, freeways and major roads, from each area. After these non-roof and parking lot areas were subtracted, the remaining developed lands West of the 805 Freeway were multiplied by 50% and those East of the 805 Freeway were multiplied by 36%. The resultant numbers, 2.85 square miles west of 805 and 4.05 east of it were added together for a total of 6.85 square miles or 1,000 square feet of roof and parking lot per Chula Vista resident when the map was made. The 50% multiplier used on the west side of 805 and the 36% multiplier used east of it are estimates based on a visual assessment of the developed areas of the Chula Vista map discussed earlier. The conclusion of this assessment is that at least 50% of the average lot west of 805 is covered by buildings, patio slabs, driveways and parking areas and that 36% of the average lot east of 805 is covered by the same. Additionally, these estimates are consistent with the lot coverage and parking regulations found in the City of Chula Vista Municipal Code, reprint of Title 19, Zoning January 2004, pp. 19-64, 19-65, 19-68, 19-72, 19-78, 19-81, 19-83, 19-86, 19-89, 19-91, 19-94, 19-

Coverage needed for the County to net-meter-out for electricity with out efficiency improvements	37.62 Sq. Miles
With efficiency improvements	22.6 Sq. Miles

Appendix 1
Footnotes Continued

97, 19-100, 19-103, 19-105, 19-119, 19-128, 19-131, 19-139, 19-142, 19-153, 19-176, 19-177, 19-237.

Appendix 2.A
San Diego County – 2010
Assumptions and Calculations used in this research brief.

Total area	4,261 Sq. miles[23]
Total land area	4,216.5 Sq. miles[24]
Population	3,211,721[25]
Total use of electricity County wide	18,639,222.82 MWh[26] (18,639,222,820 kWh)
Total average use of electricity per day Total average kWh us per capita per day with out efficiency improvements	51,066.364 MWh (51,066,364 kWh) 15.9 kWh per capita per day [27]
Total use of electricity per day if a 40% improvement in the efficient electricity use had been achieved	30,640.0 MWh (30,640,000 kWh) 9.54 kWh per capita per day[28]
Estimated total roofs and parking lots Coverage needed for the County to net-meter-out for electricity with out efficiency improvements With efficiency improvements	115.20 Sq. miles[29] 39.42 Sq. Miles 23.65 Sq. Miles

[23] SANDAG. Fast Facts, San Diego Region, www.sandag.org/resources/demographics, 9/3/06: p. 1.
[24] Email from Troy Anderson. Sr. Public Information Officer, SANDAG, (1/2/07): p. 1. San Diego County's 4,261 sq. miles includes 44.5 square miles covered by lakes, reservoirs and bays.
[25] SANDAG. Fast Facts, San Diego Region, www.sandag.org/resources/demographics, 9/3/06: p. 1.
[26] Telephone conversation with Susan Freedman of SANDAG who reported that SDG&E sold 19,544 GWh of electricity in 2005 in its service area of which San Diego County is +/- 91%. Multiplying 19,544 GWh by 91% then dividing it by San Diego County's 2005 population equals 15.9 kWh of electricity use per capita per day in the County. Assuming the same 15.9 kWh per capita per day usage in 2010, multiplying 15.9 kWh per capita per day by its projected 2010 population of 3,211,721 equals 18,639,222,820 kWh per year.
[27] Ibid. Dividing 18,639,222,820 kWh per year by 365 days per year equals 51,066,364 kWh per day. Multiplying 51,066,364 kWh per day by 60% to reflect a 40% increase in electricity use efficiency equals 30,640,000 kWh.
[28] Multiplying 15.9 kWh per capita per day by 60% equals 9.54 kWh per capita per day electricity use with a 40% increase in electricity use efficiency.
[29] The square mile estimate is based on assuming there are 1,000 square feet of roof and parking lot per capita in San Diego County. And that while this number will gradually go down as taller buildings replace shorter ones, given our current tendency for sprawl it probably won't change much in the near future. With continuing sprawl, the amount of roof and parking lot per person may actually get larger before it starts getting smaller. In any event, it probably won't change much over the next 40 or 50 years. Multiplying 1,000 sq.' per capita by the County's 2010 population of 3,211,721 equals 3,211,721,000 sq.' Dividing 3,211,721,000 sq.' by 27,878,400 sq.' per sq. mile equals 115.20 sq. miles.

APPENDIX 2.B

San Diego County – 2050

Assumptions and Calculations used in this research brief.

Estimated population 2050	3,915,085[30]
Projected average number of kWh used Per capita per day County wide in 2050 with out efficiency improvements.	15.9 kWh[31]
Total electricity use in 2050 with out efficiency improvements Total electricity projected to be used County wide per day in 2050 with out efficiency improvements	22,721,195.98 MWh (22,721,195.980 kWh) 62,249.852 MWh (62,249,852 kWh)[32]
Total Electricity used in 2050 with efficiency Improvements Average number of kWh of electricity used per day in 2050 if the efficient use of electricity is increased by 40% Average KWh use per capita per with efficiency improvements	13,632,717.59 MWh (13,632,717.590) kWh 37,349.911 MWh (37,349,911 kWh) 9.54 kWh [33]
Estimated total roofs and parking lots 2050	140.43 Sq. miles[34]
Estimated total roof and parking lot coverage needed to become electricity net-metered-out with zero efficient electricity use improvements	48.1 sq. miles 34.2% of total roofs and parking lots[35]
Total roof and parking lot coverage needed to become electricity net-metered-out with a 40% improvement in electricity use efficiency	28.86 sq. miles 20.5% of the total roofs and parking lots[36]

[30] This 3,915,085 population estimate for 2050 is an extrapolation of SANDAG's 2030 population projection of estimate of 3,855,085. The assumed population growth rate for those 30 years is .275% per year.

[31] It is assumed in this brief that electricity consumption per capita per day will stay at 15.9 kWh per capita per day through 2050, the same as in 2005. See footnote 31 and chart 1, p.7.

[32] Multiplying San Diego County's projected 2050 population of 3,915,085 by 15.9 kWh per capita per day equals 62,249,852 kWh per day. Multiplying 62,249,852 kWh per day by 365 days equals 22,721,195,980 kWh per year.

[33] Multiplying 62,249,852 kWh per day by 60% to reflect a 40% increase in electricity use efficiency equals 37,349,911 kWh. Dividing 37,349,911 kWh by the County's projected 2050 projected population of 3,915,085 equals 9.54 kWh per capita per day.

[34] Multiplying 1,000 sq.' of roof and parking lot per capita by the County's projected 2050 population of 3,915,085 equals 3,915,085,000 sq.' Dividing 3,915,085,000 sq.' by 27,878,400 sq.' per sq. mile equals 140.43 sq. miles.

[35] Multiplying 62,249,852 kWh per day kWh by 2 sq. meters per kWh of electricity produced per day equals 124,499,704 sq. meters. Multiplying 124,499,704 sq. meters by 3.86 x 10-7 equals 48.1 sq. miles. Dividing 48.1 sq. miles by 140.43 sq. miles equals 34.2%.

APPENDIX 3.A

Assumptions and calculations for the number of direct job-years required to install sufficient PV systems for San Diego County to net-meter-out – 96,862 direct job-years.

Ban-Weiss, George, David Larson, Sonny X. Li and Dano Wilusz. Job Creation Studies in California. University of California, Berkeley, MSE226, (Fall 2004): p. 3,

According to this study, 13 installation/maintenance job-years are created per MW of PV systems installed. Assuming the number of kWh used per capita in San Diego County remains at its 2005 level of 15.9 kWh per capita per day, San Diego County will net-metered-out in 2050 using 22,663,160,980 kWh that year.

Multiplying San Diego County's projected 2050-projected population of 3,905,085 by 15.9 kWh per capita per day equals 62,090,852 kWh per day. Multiplying 62,090,852 kWh per day by 365 days equals 22,663,160,980 kWh. Of this total, 13,597,896,590 kWh (22,663,160,980 kWh x 60%) will be produced by PV systems and 9,065,264,392 kWh (22,663,160,980 kWh x 40%) will be saved (supplied) through electricity use efficiency improvements.

Dividing 13,597,896,590 kWh per year projected to be produced by PV systems by 365 days equals an average system output of 37,254,511 kWh per day. Dividing 37,254,511 kWh per day by an average of 5 hours of sunlight per day* equals 7,450,902 kWh per hour or 7,450,902 kW of PV system to produce 37,254,511 kWh per day on average per year. Dividing 7,450,902 kWh per hour by 1,000 kWh per MWh equals 7,450.9 MWh per hour. Multiplying 7,450.9 MWh by 13 installation/maintenance job-years per MW of PV systems installed equals 96,862 direct job-years. (This job-year figure does not include the direct job-years that would be created if the panels and other PV system components to be installed were manufactured in San Diego County.)

*The National Renewable Energy Laboratory (NREL), Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors. P. 42, shows that coastal San Diego County (elevation 9 meters or 29.54 feet) gets a yearly average of 5 hours of sunlight per day on horizontal surfaces and 5.5 hours on collectors tilted 33 degrees from horizontal toward the South.

[36] Multiplying 48.1 sq. miles by 60% equals 28.86 sq. miles. Dividing 28.68 sq. miles by 140.43 square miles equals 20.5%.

APPENDIX 3.B

Assumptions and calculations for direct job-years required to install sufficient electricity use efficiency improvements to save 9,065,264,392 kWh of electricity per year in 2050 – 27,320 direct job-years).

Laitner, John A. (Skip). An Annotated Review of 30 Studies Describing the Macroeconomics Impacts of State-Level Scenarios Which Promote Energy Efficiency and Renewable Energy Technology Investment, pp. 2, 3, 4, 5, 6, 7, 8, 10, 13, 14, 15, 16. Also see Energy Efficiency and Jobs: UK Issues and Case Studies, A report by the Association for the Conservation of Energy prepared for the Energy Saving Trust, September 2000, Chart on p. 39. and NREL (National Renewable Energy Laboratory). Job Creation, Economic Development, and Sustainability U.S. Department of Energy, DE-AC36-83CH10093, p. 1. Although the data sources listed above related to the number of job-years created through the manufacture and installation of efficient energy use improvements are based on a variety of assumptions and differing levels of detail not easily compared, all agree that improving efficient energy use creates more net job-years than producing energy in conventional ways. This is primarily because the conventional energy production industry is capital intensive where as manufacturing and installing efficiency improvements are labor intensive. In other words, with conventional energy production, most of what we pay for it goes to the primary energy suppler whether its natural gas, coal or nuclear fuel. With becoming renewable electricity net-metered-out, the primary energy source is free and delivered free so most of the money goes into manufacturing and installing efficiency improvements and PV systems.

The above given, a conservative estimate of the jobs created through efficiency improvements from the data sources cited above is that 11 direct job-years are created per MW of electricity-used-efficiency installed. Multiplying 22,663,160,980 kWh x 40% equals 9,065,264,392 kWh that will be saved during 2050 through making our homes, businesses and industry more electricity-use-efficient. Dividing 9,065,264,392 kWh saved by 365 days equals 24,836,341 kWh saved per day. Assuming and investment of a $1,000 per kW of savings achieved for an average of 10 hr. per day or .4 kW per hr over 24 hrs, dividing 24,836,341 kWh saved per day by 10 hr. per day equals 2,483,634 kW of savings capacity installed. Dividing 2,483,634 kW of savings capacity installed by 1,000 kW per MW equals 2,483.6 MW. Multiplying 2,483.6 MW by 11 job-years per MW of savings capacity installed equals 27,320 direct job-years of employment.

APPENDIX 4

Assumptions and calculations for direct job-year required to construct the Power Link Option - 9,615.4 direct job-years).

Multiplying $1.3 billion by 40% = $520 million.[37] Dividing $520 million by $54,080 per full-time direct job-year wage equals 9,615.4 direct job-years of employment or an average of 240.4 direct job-years of employment per year over the 40 years covered in this brief. It should be noted that the Power Link will probably be finished in 5 years for an average of 1,928 direct job-years per year over that 5 year period, still 1,176.6 less than the 3,104.6 direct job-years per year over 40 years the Net-Meter Option will generate.

APPENDIX 5

Assumptions and calculations for indirect job-years to be generated through the implementation of the Net-Meter Option – 286,988 indirect job-years

To determine the number of indirect job-years generated by the two options analyzed in this brief, it is assumed that only the positive cash flow into San Diego County's from wages paid to County resident who work on installing and maintaining each option plus the consumer rebate with the Net-Meter Option will be available to generate indirect job-year wages in the County.

To be able to make a side by side comparison of the indirect job-years created by each option, it is assumed that all the direct job-years of employment required for their implementation will be filled by San Diego County residents.

Multiplying the Net-Meter Option's direct job-year total over 40 years of 124,182 direct job-years by $54,080 per direct job-year wage in 2005 dollars equals $6,715,762,560. Adding the Net-Meter Option's 10% consumer rebate of $4,864,458,207 to its $6,715,762,560 wage total equals $11,580,220,767 of positive cash flow added to the County's economy over 40 years. Multiplying $11,580,220,767 by an economic multiplier of 2 equals $23,160,440,534 of economic multiplier benefit added to the County's economy by the Net-Meter Option over 40 years. Multiplying $23,160,440,534 of economic multiplier benefit by 57% (the percent of national GNP made up of wages) equals $13,201,451,110 available to pay indirect job-year wages. Dividing $13,201,451,110 by $46,000 per indirect job-year wage, (the average 2005 wage in California) equals 286,988 indirect job-years created by Option One over 40 years or an average of 7,174.7 indirect job-years per year.

[37] The 40% of total construction job wages is from a statement made by Jim Avery, SDG&E's lead person on the Power Link Option. Paraphrasing, Avery said, "As a rule of thumb 40% of the cost of constructing large transmission lines and associated sub stations is made up of wages."

APPENDIX 6

Assumptions and calculations for indirect job-years generated by the Power Link Option – 12,887 indirect job-years.

According to Jim Avery, the Power Link Option Manager, on average 40% of the cost of constructing large high voltage transmission lines is paid in wages. Multiplying the Power Link's projected cost of $1.3 billion by 40% equals $520,000,000 in direct job-year wages. Multiplying $520 million in direct job-year wages by an economic multiplier of 2 equals $1,040,000,000 in total Power link economic multiplier benefit. Multiplying $1,040,000,000 by 57%, the percent of national GNP made up of wages, equals $592,800,000 in indirect job-year wages. Dividing $592,800,000 in indirect job-year wages by $46,000 per indirect job-year wage in 2005 dollars equals 12,887 indirect job-years of employment or an average of 322 direct job-years of employment per year over 40 years.

Unfortunately, the positive cash flow and direct and indirect job-years of employment and local business opportunities generated by constructing the Power Link Option are dwarfed by the negative cash flow that dependence on importing electricity or natural gas to produce it locally creates. At $.10 per kWh, this dependence drains an average of $1.1 billion out of the County's economy each year over 40.years.

APPENDIX 7

Greenhouse Gas Emissions and Global Warming

The release of Carbon dioxide and methane gas into the atmosphere are the two largest contributors to global warming via human activity. There is around 200 times more carbon dioxide in the atmosphere than there is methane making carbon dioxide the largest contributor to global warming of the two gases. However, molecule for molecule methane gas is 20 times more potent than CO2 as a greenhouse gas. Methane gas is released to the atmosphere through leaky natural gas delivery pipes, incomplete combustion of natural gas when it is burned, at natural gas and oil wellheads, during coal mining and by cattle and rice paddies. Additionally, global warming is causing far north and south permafrost soils to melt. Since these soils contain vast amounts of frozen methane gas their melting will release this methane to the atmosphere causing global warming to speed up even faster than now.

Greenhouse gases slow down the rate that solar energy re-radiates into space. The result of this slowing is to add energy to earth's atmosphere and oceans. A strong indication of this phenomenon is that the 21 hottest years since 1860 have occurred in the last 25 years with 2005 being the hottest recorded yet. In addition to contributing to a generally hotter climate, a warmer atmosphere and ocean causes more severe weather occurrences like powerful storms, hurricanes and tornados and more severe and prolonged droughts. Another aspect of warmer climates is an increase in the range of tropical disease carrying and agricultural pests. For example,

the habitat-ranges of mosquitoes that carry the West Nile virus and malaria have expanded further north and south and to higher elevations. Global warming is also causing the world's glaciers to melt and this melting appears to be speeding up. As a result, small rises in sea levels have already been recorded. Calculations indicate that if half the Antarctic and Greenland glaciers melt, sea level would rise 18 to 20 feet. A sea level rise of this magnitude would displace hundreds of millions of people living in low lying coastal areas and submerge much of the world's most fertile and productive agricultural soils under sea water.[38]

Although it is being sold as a way to produce electricity without producing global warming gases, nuclear power is a significant greenhouse gas contributor. According to Sidney Goodman, author of Asleep at The Geiger Counter, the nuclear power fuel cycle produces only 4% more electricity than if the fossil fuels used up to create and maintain it had been burnt directly to produce electricity.[39] If this is true, nuclear power produces only 4% less CO2 per unit of electricity produced than do fossil fuel plants. Some experts believe that even this 4% CO2 reduction figure is a myth because it does not include the energy required to dismantle old nuclear plants or to manage nuclear wastes, some of which will be dangerous for hundreds of thousands of years.[40]

[38] Gore, Al. AN INCONVENIENT TRUTH RODALE, Emmaus, PA, (2006): pp. 26, 31 – 36, 42 – 67, 72 – 73, 78 – 99, 170 – 173, 190 – 209.

[39] Goodman, Sidney. ASLEEP at the Geiger Counter. Blue Dolphin Publishing Inc., (2002): pp. 107 – 118.

[40] Ibid. p. 37. Also see Bell, Jim. Achieving Eco-nomic Security On Spaceship Earth. Ecological Life Systems Institute Inc. San Diego, California, (1995): pp. 8, 36 – 38, also free at www.jimbell.com.

Jim Bell – Ecological Designer, Author, Lecturer

Jim Bell is an internationally recognized expert on life-support-sustaining development. His projects include the design and construction of the San Diego Center for Appropriate Technology and Ecoparque, a prototype wastewater recycling plant in Tijuana, Mexico that converts sewage into irrigation water and compost. He also worked as a consultant for the Otay Ranch Joint Planning Project and the East Lake Development Company. He has also served as the ecological designer for a life-support-friendly hotel for Terra Vista Management and for the Ocean Beach People's Food Cooperative's new "green" store. Jim has more than 40 years experience in the design and construction industry. As a lecturer, Jim speaks to many groups each year. His lecture credits include the AIA California State Conference, the Society for International Development's World Conference in Mexico City, and keynote addresses at the University of Oregon's first "Visions for a Sustainable Future" conference and the State of Oregon's Solar Energy Association Conference. Jim is often interviewed on television, radio, and by the written press and has been a guest on National Public Radio and the Art Bell Show.

His honors include: The Society of Energy Engineers' Environmental Professional of the year for the Southwestern States, a "Beyond War" award, and a City of San Diego Water Conservation Design Award for one of his development projects. Jim has a Bachelors Degree of Arts in Applied Arts and Science Art from San Diego State University.

Political Involvement

Jim ran for Mayor of San Diego in 1996, 2000, 2004 Though he has not yet been elected, his ideas relating to making our region as energy, water and food self-sufficient as possible, as soon as possible are being embraced by an increasing number of elected officials, planners and City Managers. Additional to his political involvement,

Jim has served on the Board of Directors of the San Diego Ecology Center, I Love a Clean San Diego, Environmental Health Coalition, and the California Association of Cooperatives. Currently, he serves as Director of the Ecological Life Systems Institute and the San Diego Center for Appropriate Technology. He's also a Board Member of Ocean Beach People's Food Coop and is a member of the San Diego Regional Apollo Alliance.

Heather Honea – PhD. Associate Professor
SDSU, College of Business Administration

Heather Honea completed her doctoral research at the University of California, Berkeley. Currently, Dr. Honea is an Associate Professor at the San Diego State University College of Business Administration and a Research Fellow at the Centre for Integrated Marketing Communications.

She also serves on the board of a non-profit that coordinates an educational series on sustainable business and community practices and is the Chair of the San Diego Regional Apollo Alliance.

Dr. Honea's background in psychology and economics frames her different research areas.

One research stream addresses consumers' psychological reactions to direct response marketing activities and interactive consumption experiences.

Another stream examines the determinants of consumer adoption and loyalty.

Dr. Honea also models the impact of green and decentralized technologies on business, society, and consumer behavior. She lectures on how these technologies can be leveraged to generate economic, environmental, and social returns that increase the public and private bottom line. Dr. Honea's research is published in top business and marketing journals.